Assessing Trends in the System Building Process of Selected Vendors
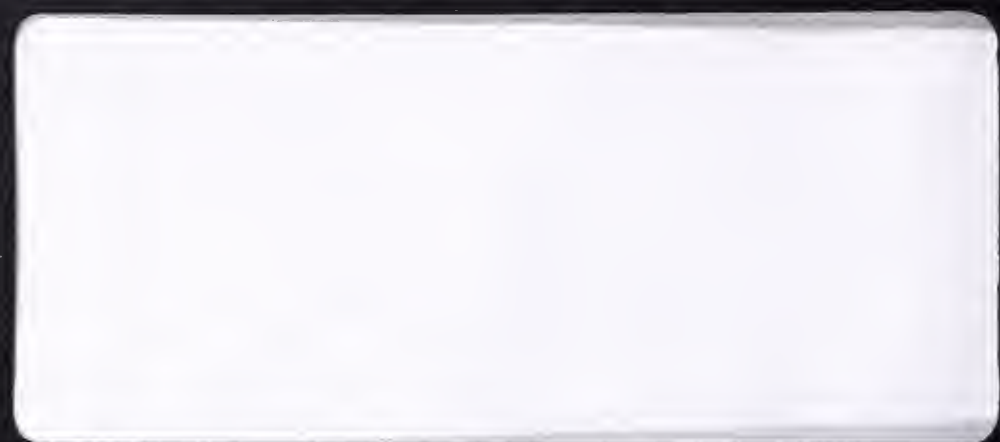
Interim Report

INPUT

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June 1993

INPUT®

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ASSESSING TRENDS IN THE SYSTEM BUILDING PROCESS
OF SELECTED VENDORS

I. BACKGROUND AND METHODOLOGY

A. Background

Andersen Consulting is considering making changes to the way in which its software solutions are created and delivered. To assist in this process Andersen engaged INPUT to examine what other vendors are doing or planning to do in this area.

Andersen and INPUT staff met in Chicago to review the background of the study on May 6, 1993. Over the next week the vendors to be targeted and the issues to be addressed were finalized.

B. Methodology

An interview guide was developed and reviewed by Andersen. The guide was intended to be a departure point for understanding the other vendor's views and plans across the broad area of system building. A copy of the Interview Guide follows the end of this chapter.

The following vendors were targeted:

> Borland
> CAP Gemini*
> Cambridge Technology*
> D. Appleton (DACOM)*
> DEC*
> EDS
> HP*
> IBM*
> Microsoft
> Oracle*
> Texas Instruments
> Xerox (Parc)

The firms followed by an * have been interviewed and their results are contained in the report. The others are in process and will be contained in the expanded final report.

INPUT has already made in excess of 75 contacts at these firms to obtain information.

- In some cases, a single person is able to provide all or most of the information required. This is generally because the company has centralized the function and/or has it well-coordinated. Even in this category, it has often taken a number of tries and referrals to find the correct person.

- In other cases (about half so far), responsibilities for software building are diffused throughout the organization. Up to six interviews have been required in this type of organization

INPUT was not sure at the beginning of the study what kind of reception the study would receive. In fact, every company approached has been very interested in the subject and, equally important, quite willing to take part in the study. The interview guide itself has been a significant "selling point" in motivating vendors to take part. The only limitations have been finding the right person and accommodating their schedule.

Because of this elevated level of interest INPUT has not found it necessary so far to promise anonymity. In a few cases proprietary or sensitive information has not been reported here; but this kind of information has been infrequent and, in INPUT's opinion, has no effect on findings.

INPUT believes that being able to associate the findings with actual companies, rather than, "A", "B", "C", etc. will make this information more useful for Andersen. INPUT does request Andersen, however, that this information be treated with care and not widely publicized, at least without masking the identities of the vendors adequately.

Three of the remaining companies are scheduled in the next several days and INPUT expects to have all companies' interviews completed by early July.

C.   Organization of This Report

The remainder of this report is organized as follows:

Chapter II: Summary Analyses - This will be INPUT's conclusions based on the full set of interviews; this will appear in the final report.

Chapter III: Summary Matrixes - This very concisely summarizes material under the 13 categories in the Interview Guide. For more detail, the full text in Chapter IV should be consulted.

Chapter IV: Summary by Category - This provides the full text for each vendor within each category.

Chapter V: Summary by Vendor - This is the same information as in the preceding chapter, but organized so as to give a profile of each vendor.

CHAPTER II:

Summary Analysis

[This will appear in the final report.]

CHAPTER III:

Summary Matrixes

1. CHANGES IN THE SOFTWARE BUILDING PROCESS (OVERALL)

Cambridge Technology

Techniques: Rapid Prototyping
Development Time: Speeded up 3 times
Cost Reduction: Reduced
Quality: Increased

Cap Gemini

Techniques: JAD, RAD, partner tools
Development Time: Reduced by 25%
Cost Reduction: Somewhat
Quality: Some increase

DACOM

Techniques: Process Modeling
Development Time: Probably decreased
Cost Reduction: Probably decreased
Quality: Much higher

DEC

Techniques: JAD, RAD
Development Time: Reduce by 33% (goal)
Cost Reduction: Somewhat
Quality: Some increase

HP

Techniques: Focus on client/server
Development Time: Reduce by 25%
Cost Reduction: Reduced by 20%
Quality: High priority

IBM

Techniques: Many
Development Time: Reduce by 30% (?)
Cost Reduction: Reduce by 25-30%
Quality: Important

Oracle

Techniques: Rapid prototyping
Development Time: Reduce by 30%
Cost Reduction: No
Quality: Zero defects (goal)

2. SOFT BENEFITS

Cambridge Technology	o o o	Better communications Test concepts of reengineered business Improve requirements specifications
Cap Gemini	o	Help understand how business processes will change
DACOM	o o o	Benefits accrue to underlying business Reduced cycle time, improved maintenance End users are part of team
DEC	o o o	Better communications Improved customer satisfaction Increased responsiveness to customer needs
HP	o o	Improved customer satisfaction Reduced cycle time for business transactions
IBM	o o o	Improved communications Improved customer satisfaction Customer review of systems
Oracle	o o	Improved communications Replacement of paper with electronic interactions

3. RELATIVE CONTRIBUTION OF TOOLS AND PROCESSES

Cambridge Technology

Tools: Important to the extent they are part of the process
Processes: Rapid prototyping very important; parallel teams with a factory-like flavor are also important

Cap Gemini

Tools: Tools supplied by partners play an important secondary role
Processes: Process is most important; some consideration to factory approach; some dependence on skilled consultants

DACOM

Tools: Tools are secondary
Processes: Modeling process is key; significant dependence on skilled consultants

DEC

Tools: Moving away from priority placed on tools
Processes: JAD and RAD expected to have more impact; software factories being investigated

HP

Tools: CASE and other tools secondary
Processes: Focussing most attention on process

IBM

Tools: Direction unclear, but tools are important
Processes: Direction unclear

Oracle

Tools: Important, symbiotic with process
Processes: Important, symbiotic with tools

4. REUSABILITY

Cambridge   o   Not a focus
Technology   o   In principle, their process of separating functions in
                          implementation supports reusability

Cap Gemini   o   Exploring feasibility

DACOM   o   Do not see theories for supporting reusability in commercial
                          market
           o   Have seen little potential for reusability in processes which
                          appear similar on the surface

DEC   o   Experimenting both internally and with their VARs
           o   Have tools to support reusability

HP   o   Very little being done in custom code
           o   More attention in product area

IBM   o   Experimenting
           o   Being used in system software development internally

Oraclé   o   Reusability is an objective
           o   More opportunities in an "all Oracle" environment
           o   Need to develop standards

5. CLIENT/SERVER MODEL

Cambridge
Technology

Problems Seen: Incomplete model
Vendor Direction: Integrate with reengineering

Cap Gemini

Problems Seen: Incomplete model [INPUT note: CGA may not fully understand issue.]
Vendor Direction: Part of systems definition

DACOM

Problems Seen: Very incomplete model
Vendor Direction: Understanding business process is critical to avoid painful mistakes

DEC

Problems Seen: Incomplete model
Vendor Direction: Address technical issues

HP

Problems Seen: Comfortable with overall model; still need to link redesigned processes to client/server model
Vendor Direction: Continue improvements

IBM

Problems Seen: Incomplete model
Vendor Direction: Addressing separating of processes and data

Oracle

Problems Seen: Incomplete model, especially in heterogeneous platforms
Vendor Direction: See standards as assistance

6. SYSTEM BUILDING MODELS/APPROACHES

Cambridge Technology
- o   Use a single process model
- o   High degree of management control

Cap Gemini
- o   Primary and secondary models
- o   Medium-high degree of management control

DACOM
- o   Use a single process model
- o   High degree of management control

DEC
- o   Multiple process models; efforts are coordinated
- o   Medium degree of management control

HP
- o   Multiple process models; coordination is attempted
- o   Medium-low degree of management control

IBM
- o   Multiple process models, more being added
- o   Low degree of management control

Oracle
- o   Multiple process models
- o   Low degree of management control

7. SKILL NEEDS AND DISTRIBUTION

**Cambridge
Technology**
- o Skills in short supply, distributed unevenly
- o Continuing education

Cap Gemini
- o Skill bottlenecks
- o Use outside staff
- o Continuing education

DACOM
- o Lack of skills is biggest problem
- o Forced to hire senior staff
- o Internal training is largely on the job

DEC
- o Need new skills, not always available internally
- o Continuing education
- o Use outside staffing sources

HP
- o Technical skills are not a problem, given culture
- o Project management biggest gap

IBM
- o Skills are in short supply; cutbacks have made situation more acute
- o Continuing training
- o Use outside contractors

Oracle
- o Skills not perceived as a problem due to culture

8. SYSTEM TESTING PROCESS

Cambridge
Technology
- o   Tested at prototype stage
- o   Heavy user involvement

Cap Gemini
- o   Tested at early stage
- o   Users involved

DACOM
- o   Testing done at model level

DEC
- o   Want to incorporate testing as part of system building process

HP
- o   Significant changes due to client/server
- o   Testing automated

IBM
- o   Changes made in tools and systems review
- o   Users increasingly brought into process

Oracle
- o   Now an on-going process involving customer
- o   Testing becoming much more complex; still involves considerable manual testing

9. INNOVATIONS (SELF-ASSESSED)

Cambridge Technology	o	Methodology
Cap Gemini	o	Combination of their own experience and tools from other vendors
DACOM	o o	Emphasis on modeling of business processes Making customer part of team
DEC	o	Factory-like code development
HP	o	Don't see themselves as innovative per se
IBM	o	Various technical initiatives, largely with partners
Oracle	o	Methodologies for continuous refinement of systems

10. COST OF MAKING IMPROVEMENTS IN SYSTEM BUILDING

Cambridge Technology
    o   Sees payoff in near term
    o   Controls in place to balance cost versus benefits

Cap Gemini
    o   Seeks to control and limit these costs
    o   This is one of the reasons for using outside partners

DACOM
    o   Very high costs, especially relative to their size
    o   Long term payoff

DEC
    o   Long term benefit expected; short term benefit hoped for

HP
    o   Pulling together the client/server process model cost up to $1 million in addition to uncounted staff time
    o   Benefits are immediate once the learning curve is out of the way

IBM
    o   Cost is unknown
    o   Near term and longer term benefits expected

Oraclé
    o   Cost is unknown
    o   Viewed as long term investments

11. SUCCESS/FAILURES

Cambridge Technology
- o   They see their process as responsible for their success.
- o   Do not admit to any failures

Cap Gemini
- o   The believe their approach minimizes the risk of failure

DACOM
- o   They see their recent success as a company due to their approach
- o   Significant failures in past - became a learning experience

DEC
- o   Would not discuss success or failure

HP
- o   The client/server model now leads to success
- o   There were failures in early implementations of the client/server model

IBM
- o   Success has been mixed with failure; due to the fragmented nature of these efforts lessons or patterns are hard to draw

Oracle
- o   Out of Oracle's public failure in introducing applications products came the changes that are now producing success.

12. OTHER ORGANIZATIONS TO WATCH

Cambridge Technology
- o TI
- o Andersen

Cap Gemini
- o Big 6
- o Andersen

DACOM
- o James Martin Associates

DEC
- o James Martin Associates
- o KnowledgeWare
- o Andersen
- o Cambridge Technology

HP
- o Dupont
- o Farmers Insurance
- o Microsoft
- o Andersen

IBM
- o Microsoft
- o Next
- o TI
- o KnowledgeWare

Oracle
- o Several corporations (confidential)

13. CHARGING FOR HIGHER VALUE SOFTWARE ASSETS

Cambridge Technology	o	Believes it would be difficult to charge a premium
Cap Gemini	o	A premium might be possible in a long term relationship
DACOM	o	Do not think that customers will be educated enough to pay a premium for many years
DEC	o	Not sure how premium could be computed
	o	Would be necessary to guarantee the higher value in some way
HP	o	Doesn't believe that higher value assets will in fact be created
	o	New kinds of assets may be created
IBM	o	Not sure how additional value can be made clear to the customer
Oracle	o	Believes asset value of software will decline because of shorter life
	o	"Information assets" may increase but unclear how to measure value

CHAPTER IV:

Summary By Category

Changes in the Software Building Process (Overall)

Cambridge Technology

They have introduced changes to bring about more rapid development and will add to or refine them in the future. They have speeded up the development process or time to develop an important or strategic application system by a factor of 3 (time to completion and use of the system) compared to similar projects at a client or other company where traditional methodologies or even some newer methods were used. (This appears to be so, but is based on using people with considerable knowledge and experience employed who impose a methodology that forces higher level user executives to provide timely and meaningful contributions to the process.)

The process allows the cost of the software building process to be reduced (including the person months involved) and the quality to be increased.

The development technique includes a well planned and executed preliminary requirements definition, rapid systems prototyping methodology to pin down requirements and parallel development teams to implement the system. (Top user executives are forced to provide timely and dedicated reviews of the results of the prototype through the activities of CT.)

Cap Gemini

They have ongoing programs concerned with improving the software building process, although their main concern is satisfying the needs of clients in specifying, delivering and installing business systems. They focus attention about improvements in the software building process on activities of software engineering firms such as Intersolv and Bachman who have been business partners.

Changes in the process which would speed up the development of business solutions, increase quality and/or reduce costs could increase competitiveness and be important to us. Improvements are being obtained on a regular basis, but they would like to see a substantial or notable change that could reduce the time for large, complex projects by 25% or more. This would gain attention from clients and prospects. However, control of change to their process is most important.

DACOM

The current approaches, especially CASE, haven't just reached a dead end but have lead us down the wrong dead end: The problem isn't producing code efficiently and correctly, but designing the right systems in the first place.

DACOM began as a CASE-oriented, essentially product, company in the early 1980s. It built reasonably good tools and was (and is) a leader in repository thinking. However, over time DACOM saw that the chief need was for an understanding of business processes and making improvements in the systems which support business processes.

DACOM has evolved from a company with an emphasis on software building to one that works closely with clients to design the right system in the first place. Software "implementation" is viewed by DACOM as almost easy once the underlying business design is set.

Overall time to complete may or may not be shorter compared to conventional methods. Much depends on how well their clients have been educated in the DACOM method. Initial projects are usually slower because of education and cultural change. Subsequent projects are probably shorter; however, this is very difficult to measure since historical measures of time to complete don't do justice to the time spent on the up-front business engineering phase.

Actual software development is much faster after DACOM's work:

- There are relatively few downstream changes

- The "specs" are unambiguous

Quality is immeasurably higher, although, again, there are few benchmarks and measuring methodologies for quality. This is very frustrating for DACOM because they and their clients strongly believe this to be true, but it is very difficult to prove. Other vendors make similar claims -- which DACOM doubts are true -- and DACOM's real achievements (to them) get lost in the general noise level.

DACOM admits that they could do a much better job at quantifying benefits, in order to

- Measure their own progress

- Assess the relative strengths of different approaches

- Market themselves better

Right now, too much of their acceptance is based on clients buying into the DACOM "religion". This is ironic and frustrating for an organization that views itself as a rigorous, engineering-oriented company.

Digital Equipment

Changes are being considered or made to speed up the development of software as well as to reduce its cost and improve quality. Many separate activities are taking place ranging from steps in consulting and systems planning to work at all levels with tools and methodologies. Specific goals have not been quantified or can't be discussed, but it seems that the speedup being sought at this time would reduce development time by one third on larger projects.

Hewlett-Packard

The driving force behind changes in the systems building process at HP is to reduce the time required to deliver projects while improving the overall quality of the finished product. HP's area of emphasis is on the management process for building systems, not on tools. They are placing emphasis on the re-engineering aspects of the business process, and simultaneously trying to develop a methodology which will apply a rigorous discipline to the resulting systems implementation.

They do believe that tools are important. However, they believe that 90% of the errors occurred at the front end, where few tools are of much use without an overall re-engineering of the business process.

They believe that their emphasis on re-engineering focusing on downsizing, organizational changes, process re-design within reasonable cost containment guidelines of the client, is the primary thrust of their rethinking of the systems development process.

Reduced cycle time on the completion of business systems re-engineering project, including the generation of finished applications systems - 25%. They would not give a specific example.

HP is trying to define quality as "fit to business need" within the client's anticipated time frame. Their position is that counting bugs in the code is secondary.

HP has not made much progress on reusability. Reusability per se is not a goal. Studies that they've conducted indicate that there is huge waste in the current process which could be significantly reduced if a set of standards could be developed along with a process to better manage code; identify and select modules to be developed and maintained as "reusable", etc. However, they feel that the process is a long way off.

The main problem is that in order to generate reusable modules, the development process must be integrated or contain components and standards which insure reusability. They think that most firms are farther behind in this area than they are in CASE. (In HP's view, most firms aren't very far along in the effective integration of CASE into the development process.)

Very little is being done to obtain any more meaningful quantification of benefits than was done in the past. This process becomes even more complex when significant business re-engineering is involved. In some instances various components could be readily quantified, but that inmost instances where business investment on the basis of much softer criteria.

IBM Corporation

There are changes being made by groups in a number of areas including professional services, external consulting, SI projects, ISSC and internal software groups. IBM's interests include business systems planning, project management, methodologies and tools. Separate activities are also being carried out with business partners.

Internal professional services and software groups are under pressure from users to speed up the development process or time to develop an application system. The reduction of development time by 50 to 100% is mentioned by users as an objective although any meaningful reduction in the overall process (e.g., 20 - 33%) would be well received. IBM recognizes these objectives, but does not have a specific target. However, IBM recognizes that changes of this magnitude will require consideration of all aspects of the process from concepts of business analysis and re-engineering to project management and code generation.

Users also want to reduce the cost of developing software for a system. The reductions being sought by users are at least 30 to 40% and as much as 100% Although there is not any official target, IBM research in Endicott, NY has talked about helping users achieve a reduction of 25 to 30%.

Another objective is to allow the time and cost required to modify software to be reduced.

A different type of objective is to develop software with a higher level of quality. In addition to programs that can be more easily modified and understood, two concepts were mentioned in regard to this. Users have stated that they are interested in systems building that would automatically incorporate various types of input data validation and other cross footing that is suitable for the type of application being developed. The second concept involves enriching the development process or adding tools which will check out the logic of software during the process and leave a structure in place for acceptance testing and testing of modifications at a later date. Auditing should also be facilitated.

Many ideas about quality are prevalent. One recommendation mentioned by users is to ensure that developed software should not be fragile or become fragile when normal types of changes are incorporated or added. Users also feel that procedures or tools should guaranty that software modules can be reused or used as an object(s).

Oracle

The principal changes taking place in the process are driven by three fundamental driving forces.

- A migration from IS to the end-user as the leading player in the development process.

- The maturation of a new life cycle based on rapid prototyping, utilizing increasingly sophisticated tool sets.

- A growing demand for rapid turnaround and responsiveness for changes to whatever system is in place.

Both downsizing from the mainframe and upsizing from standalone departmental systems to departmental work group systems is occurring simultaneously. In either case, the traditional life cycle that was used for mainframe development is or will be replaced by the cycle described below.

- Rapid prototyping of a systems basic functionality. (Joint effort of specialists - either vendors or IS - and end-user experts.) The prototype then goes into limited production.

- Refinement and rollout of the full blown system. (Joint effort of specialists and end-user experts, and based on feedback from operating the prototype in production mode.)

- Integration of the refined system with related systems. (Primarily a specialist implementation activity based on requirements identified while operating the refined system in production.)

In other words the traditional concept of a formal requirements phase is replaced by three less formal requirements definition phases. In fact each phase of the traditional life cycle has a three counterparts in the new cycle; design, development, testing, etc.

Oracle sees itself as being involved in this process in several ways:

- As an innovative tool supplier

- As a teacher/coach

- As a high level consultant and/or implementor

- As a developer of applications software (for internal use or, perhaps, in partnership with a client)

- As a supplier of flexible applications (where Oracle may again become involved as a teacher, consultant or implementor)

These are complex roles and Oracle is the first to admit that everything isn't sorted out yet.

Meeting the real business requirements of the end-user, and shortening the time from inception to delivery in order to capture user benefits early. This fundamentally comes down to:

- Reduced training time

- Shortened development cycle to first usable version of the system

- User self-sufficiency in terms of on-going modifications, etc.

Oracle does not believe that there is likely to be a reduction in systems development costs (at least in terms of reduced manpower) over time. The more likely scenario is that implementations will have four to five times the functional capability for the same cost.

Oracle believes that the creation of new interactive applications using their redefined life cycle and tools can be accomplished in 70% of the time it would take to achieve the same functionality using conventional CASE and methods. For batch based applications or the generation of new reports, etc., they believe the number is 25%. (See attached diagram showing how newer approaches to system building generate benefits.)

Quality is customer satisfaction with the provided functionality, and "0 defect code".

In a homogeneous environment (Oracle Platform) they estimate that a fair amount of the code can be re-used. But this is not an objective unto itself. In heterogeneous environments (say using DB2 along with Oracle), less will be achieved in terms of reusability.

Oracle believes that the industry is a long way off from obtaining reusability on any major scale through the development of "objects". Probably the highest level of reusability comes through the creation of user "customizable" applications software products.

Very little quantification of benefits has been done. Most end-user projects (which are an increasing proportion of the total) seldom undergo a formal justification or subsequent audit process.

Cambridge Technology

The use of rapid prototyping during the requirements definition helps to improve communication about requirements as well as to analyze what is going on in business processes. If business systems are being re-engineered, concepts can be tested out. The prototype software enables users to review systems and gives them a feeling of satisfaction with the final implementation.

Cap Gemini

Improvements in software building should include steps to aid users to review how business processes will be changed or re-engineered as well as to review data management and utilization. Improvements in software engineering tools have aided both of these objectives.

DACOM

DACOM would take issue with the concept of "softer" benefits. The benefits are softer only from the standpoint that many (maybe most) of the benefits do not accrue to software building, but are gained by the underlying business. (DACOM agrees that it would be very powerful to measure the "before" and "after" business costs and benefits, but it does not do so on a consistent basis. Its clients don't want to pay for this kind of activity, because doing so won't help solve their particular business problem.}

DACOM works largely with true end users in the manufacturing/logistics area. From the standpoint of DACOM's clients the current system building process is "intolerable" and not just for the usual reasons of lateness and expense. The more thoughtful clients (and DACOM appeals to thoughtful clients, for better or worse) are frustrated by software that

- Doesn't meet their business functional needs very well.

- Behaves in inconsistent and unpredictable ways; users are overwhelmed by system details; computer systems make it harder rather than easier to understand underlying problems.

- Is difficult to change in the terms of time and expense and, even then, often can't really be changed to meet user needs

Downsizing of organizations and of the computing environment multiplies these problems

Their clients don't really care about the usual measures used to measure a "good" software project.

Digital Equipment

There is a definite need to achieve other, softer benefits for customers including improved satisfaction with the development process, improved communications on the work being done, and more ability to respond to needs. These needs are being investigated in relation to systems integration and professional services work as well as in relation to internal analyses of systems building.

Hewlett-Packard

HP's experience has been that the two dominant soft benefits that firms are using to justify re-systemization (and business re-engineering) efforts are:

• Improved customer satisfaction; and

• Reduced cycle time on core business transactions

Certain of HP's customers have taken to trying to measure both of these factors; but it's still difficult to relate the measures to the bottom line performance of the firm.

IBM Corporation

Software should facilitate efforts to communicate as well as to analyze what is going on in business processes. There should be a view(s) of software that enable users to review systems and give them a feeling of satisfaction with the software.

Oracle

As firms begin to leverage the concept of information distribution and collection utilizing the interactive capabilities of modern technology significant benefits will be realized in terms of better communications both deferred and direct. This will include interaction between individuals in a firm as well as between an individual and the corporate repository of knowledge. Applying these same systems design concepts to interactions with customers, etc. will bring another whole set of benefits.

The typical knowledge worker spends between 10-15% of his/her time today interacting with paper. As the level of integration of systems goes up and the ability to interact on an as needed basis with the corporate repository grows, knowledge workers will spend probably 20-25% of their time working with information electronically.

In Oracle's view we're just seeing the tip of the iceberg in terms of understanding, articulating and realizing some of the significant benefits that can be achieved through the migration to interactive systems at all levels.

Relative Contribution of Tools and Processes

Cambridge Technology

Both tools and processes are used in the CT Partners methodology. The rapid prototyping capability is more of a tool-like technique that allows concepts to be tested.

The development of the implementation code by the use of parallel teams is more of a process or factory like method in which one team handles the application, a second handles connectivity, a third the user interface, and a fourth the data.

Cap Gemini

As noted above, tools have brought ongoing improvements in the software building process, but changes in the overall process have made the greatest impact on their ability to deliver timely and quality work, and we would like to see an improvement in the process that would provide a substantial improvement in time and cost requirements while also enhancing quality further.

They are reviewing the use of factory-like methods to generate code although most of the effort is devoted to working with users and difficulties could occur in trying to implement a factory process in that situation.

DACOM

DACOM has a full perspective, having started as a CASE company (before the term was invented) and now describe themselves as a "systems integration consultant."

DACOM does use tools, some of which are their own (see attachment 1).

However, they see tools as essentially supporting a model-oriented approach ("Tools are the finger painting of business engineering").

- They see almost all CASE tools as not supporting the improvement of business processes (although pieces of them can do so with the right orientation)

- A good repository is vital, but they don't know of one that really meets their needs.

- They are forced to use and link standalone tools. They hope that in the future there will be integrated tools that will support a range of modeling techniques.

A key component (and bottleneck) is the need for consultants with the necessary "wisdom" to integrate the business problem, modeling techniques and client change. This is the strength of their business, but also a key limitation.

- These traits make them valuable to customers, but expensive.

- DACOM would like to be able to leverage this knowledge in a more embedded methodology. They see the application of AI and fuzzy logic as possibilities, but are currently resource-constrained in being able to pursue these directions very aggressively. (They are especially cautious since in the past they have tried to prematurely productize processes.)

The general process that they use is shown in Attachment 2.

Digital Equipment

Tools including CASE tools and other software aids are being sought and evaluated to aid with the system building process. Tools may seem to be more important in regard to current improvements in systems building, but improvement of the entire process that is carried out in systems building offers more opportunities for improvement.

The use of techniques such as JAD or RAD as part of a process are expected to have more impact on time, cost and quality than tools can.

Research is being conducted that addresses both the use of tools and processes to improve the system building process. The use of manufacturing techniques in software production has been carried out and is also being investigated together with other topics.

Hewlett-Packard

HP believes that the biggest contributions are coming through improvements in the process and people management aspects of the systems building process. CASE tools and other automated approaches are important but secondary. They have adopted an approach which pairs top-flight project managers with tailored teams for specific implementations. Project managers are responsible for projects only. Team members are managed in the personnel and development sense by other managers within their home organizations.

- They have installed new processes that permit feedback between project managers and those managers in the firm who are responsible for the development and administration of individuals within the organization.

- They have installed a special program to continually improve even seasoned project managers skills.

- They are using some incentive programs for project performance and quality on an experimental basis, but these programs are immature in that they tend to reward heroic fire fighting efforts...rather than solid fire prevention on a day to day basis. Incentives (both team and individual will probably play a stronger role in the future.

IBM Corporation

CASE won't achieve all the objectives that are being discussed for software but CASE tools can aid by enabling software to be analyzed, modified and generated more easily for a number of applications. It was noted that certain applications that require high levels of transaction processing might require attention from personnel that were experts in the alternatives and tools available to meet tasks. One project mentioned in this regard involved an RS/6000 system that AIC worked on in conjunction with the research staff in Austin.

An expert on GUI has been hired by IBM in Endicott, NY to develop special tools to support and guide developers in implementing certain types of workstation systems faster and with more quality.

In regard to the use of tools, it is felt that AI and particularly expert systems, as well as other capabilities should be able to be incorporated as objects in the software development process.

It is felt that the process of systems development must address a much broader set of needs than tools can address. For instance, it must address changing work structures such as work groups and other changes in work organization or people management.

Ideas for the application of manufacturing techniques to software building are also being considered, tracked and experimented with although it is felt that it may be difficult to achieve other objectives such as improvements in communication as mentioned above together with software manufacturing.

Oracle

New tools and changes in processes are probably making an equal contribution; and they continue to evolve in an iterative manner. The methodology that Oracle endorses of rapid prototyping, refinement and integration has stimulated the need for new functionality in the tool set. And, the capabilities that are subsequently generated in the tool set provide opportunities for further refinement in the design and implementation processes.

CASE tools are either obsolete or essential. If they are integrated with rapid prototyping methodology and deal with the concept of distributed architecture, they are essential. Tools that "assume" the kinds of structured methodologies of the 70's and 80's are probably obsolete because they don't integrate with current methodologies or architectures.

AI, like many other buzz words (including CASE), has gotten a bad name. However, if you look around, you'll see that expert rule based systems are imbedded in everything from spreadsheets and word processors to systems development tools. The use of these technologies to support the systems building process will continue to grow, and will result in both reduced development time and higher quality code.

The biggest single change on the people and organization side was the migration of development responsibility from IS to the end-user. Distributed IS has changed the process. The result is more teamed approaches which hopefully combine the required technological expertise with user knowledge of business process.

In terms of management techniques, people are still going to be people and managers will still vary in quality. However, the teaming of users and technical personnel in the development process will and should continue to reduce the complexities of management by improving communications. New tools and processes will continue to reduce the number of people required to accomplish an implementation (and therefore the complexity).

Oracle believes there is some fallacy in the notion of "manufacturing" code. Manufacturing implies making a large quantity of the same (or essentially the same) thing. Building applications involves using common processes to generate unique systems. The thing that they have in common is the use of consistent (but obviously different) processes... little else.

Cambridge Technology

The methodology described above has not focused on reusability, but the use of parallel development efforts would facilitate the consideration of reusable code since functional aspects of coding are separated.

Cap Gemini

Cap Gemini and its business partners are exploring the use of reusability of objects as well as object oriented programming, but this is one of many efforts to improve methods.

DACOM

They are attracted to the concept of reusability but have found only a small number of "paradigm processes" which they can see as potential candidates. For example, "inventory" should qualify, but doesn't once the major differences between industries are examined as well as the "flavors" between firms.

They see no theory of reusability in the commercial world (unlike the formulas in the scientific world) to make their job easier. They use common skeletons and analyze differences but don't really view this as reusability.

They reuse "wisdom" and are aware of the deficiencies in doing so.

Digital Equipment

Tools are being used that allow a repeatable solution to be sold. For certain applications, these tools will allow the solution to be modified or customized more easily, and many components of the solution would not have to be changed. There have been various types of reusability in the past by DEC VARs as well as by DEC. Digital has also been experimenting with reusing objects in a group of internal projects and is now doing that on a regular basis

Hewlett-Packard

Very little is being done by HP in the reusability concept as applied to custom code development. However, a significant amount of work is going into refining process which will insure reusability of some significant portion of the code that's developed for applications or systems software products.

What is being done in this area is proprietary to HP and its products. They are still a long way from the point where the generation of "universal objects", etc. will be commonplace

IBM Corporation

Reusability was mentioned several times as an objective in relation to the goals stated above. The objective was stated as creating software that can be reused and/or facilitate the reuse of other software whenever feasible.

Ideas have been tried out internally by IBM in Boca Raton, Austin, and other locations to reuse software during systems software development.

Research projects have also been carried out to test reusability and other concepts and to track user and vendor work with reusability.

Oracle

From Oracle's point of view, reusability is an objective. However, a lot of effort will need to be placed into the development of standards, and the consistent use of sophisticated tools before this will be accomplished through "object" libraries. In the meantime, Oracle targets on being able to reuse higher level application definitions to "regenerate" code. Modifications to the definitions at the high end allow customization; and the use of tools allows new custom code to be generated at minimal cost.

There may not be much progress was likely to get made in generating reusable modules at the user interface, since this is an area where systems providing similar functionality were liable to vary significantly based on personal and organizational preferences.

Difficulties in Addressing Client/Server

Cambridge Technology

There can be difficulties since corporate objectives as well as processes and data can be divided between uncoordinated systems on client/servers. Cambridge Technology allows client/server systems to be handled by themselves or better yet, together with other, related systems changes that are necessary to meet corporate goals. The methodology utilizes open systems which facilitates work with a variety of client/server technology.

They also test out application approaches with rapid prototyping that should highlight questions about the segmentation of functions and data across systems.

Cap Gemini

The needs of users have to be fully understood before decisions are made regarding the technology that will be used in a solution. Decisions are made too quickly in regard to the use of client/server technology, and problems can result in relation to data management and the division of functions between business units.

DACOM

The client/server model is extremely incomplete. More basically, there is no model for organizational or functional downsizing. This puts a process engineering in a double bind. Learning for DACOM is "painful" and largely intuitive as far as where data, processing and location boundaries are drawn.

This disturbs them less than may appear, since the analytic process involved in understanding the business processes will usually keep them from making unrecoverable mistakes in "client" and "server" function allocations.

They feel great sympathy with their partners (whether customer-partners or vendor-partners) who are trying to make client/server technology work.

Digital Equipment

There are questions about the allocation of data and processes from a consolidated system to a number of client/server systems. There are also questions about using a set of data or transactions received at one point to update multiple client/server systems.

Hewlett-Packard

HP has been working at the C/S model in an open systems environment for some number of years. They are very comfortable with it at this point, and have a formally documented approach for allocating functions and data between clients and servers. (As is the case with reusability, the model is proprietary to HP and might not be applicable to other platform architectures.) The model is supposed to be rigorous and has significantly improved the quality and efficiency with which new applications can be developing using C/S.

They still needed to improve the overall process at the design level. The area that needs the greatest improvement is a consistent approach to linking redesigned business processes with functional specifications for C/S systems. They are working on this.

- They have just dropped KnowledgeWare in favor of IEF as their primary CASE vendor.

- Anticipate that IEF organization will work jointly with them on tailoring CASE tools to meet HP's needs both at the design and implementation levels.

A formal model for the C/S design process has significantly improved the quality and reduced the time required to systematically test new code. Estimates that they are saving about 20-25% in this area, and are certain that the quality of the code is higher.

IBM Corporation

Difficulties involved in separating processes or splitting the management of data have not been fully addressed. IBM thinks that these problems have often led to the use of larger capabilities, AS/400s rather than work stations, in many client/server systems.

Oracle

Oracle believes that the C/S model is incomplete. When utilizing a consistent platform on any given set of applications (the Oracle platform) they have a consistent way to model the distribution of processing and data. It's pretty straightforward. Shared functions and data go to the server, and unique functions and data go to the client. However, when working with heterogeneous platforms (in particular data bases), the ability to follow the model is frequently inhibited by differences in functionality in hardware and software.

Over time, the migration to more open systems and standard interfaces will likely increase the level of consistency that can be achieved in allocating data and processing in the C/S environment. In any event, its not a serious enough problem that it is likely to inhibit the ongoing emergence of C/S as the primary applications platform.

Is More Than One Process Model

to Improve Systems Building?

Cambridge Technology

CT Partners uses only one process model, although improvements to it are considered, evaluated and implemented over time. They have a high degree of control over management of change.

Cap Gemini

Within CGA, there is an effort to use one model although experimentation is made with other models. We are willing to support projects at users that employ models different from the one we support internally. Some individual offices or personnel are attempting to change methods, but control is achieved. They have a medium-high degree of control over the management of change.

Due to uncertainties about the systems building process as well as the lack of coordination between various department in a company, multiple models may be in use at a client, and they might be involved in supporting more than one.

DACOM

They have their own approach (attachment 2). However, they feel agnostic toward particular business analysis practices and feel it is too early to back one horse. They have a high degree of control over the management of change.

Digital Equipment

DEC is using multiple process models, but most of these efforts are coordinated. In some circumstances, activities in support of accounts could use tools and techniques or new methodologies in an unplanned manner to improve systems building. Where a VAR or associated vendor is in a lead position, this is particularly true. They have a medium degree o control over the management of change.

Tools are available to help manage or control change management at DEC, but they are not always used.

Hewlett-Packard

HP is definitely trying multiple approaches to improving the systems building process, but the process is not seen internally as very well coordinated. Individual initiatives appear to pop up, and get piloted. Informal communications between people involved in these efforts are the primary method of coordination. However, enough information gets shared to insure that some "best of breed" approaches are emerging.

There is a group manager whose responsibility it is to gather, digest and redistribute information on the new techniques and approaches that emerge. Overall, they have a medium to low degree of control over the management of change.

IBM Corporation

IBM has a number of process models available to improve systems building and is constantly in contact with other vendors to make arrangements to share and try out their ideas (e.g., recent agreement with HP on client/server development products). They have a low degree of control over the management of change. Many offices (but not all) are supportive of change due to this. IBM contacts in professional services assignments feel that this emphasizes that the most important element in the improvement of systems building is the experience and knowledge of industries and application systems.

IBM points out that some large corporations such as several of the top banks are trying to use more than one process model for improving systems building. This has occurred chiefly due to unplanned pressures by users for different alternatives for systems building. There may not be an adequate means of managing or coordinating change in these situations even if IS tries to coordinate or manage change in situations where more than one model is operative.

Some areas of organizations are more supportive of change, particularly users who are under pressure to achieve business goals.

Oracle

Yes, Oracle is certainly trying more than one model. Two examples have already been cited; the rapid prototyping process and the creation of "customizable" applications packages. More are likely to be tried in the future.

In terms of how the process is being managed... at Oracle it's ad hoc. Overall, they have a low degree of control over the management of change.

Cambridge Technology

Higher level skills are in short supply and distributed unevenly. CT Partners provides a method that allows the need for skills to be managed and controlled more easily.

The CT Group, an affiliated organization, provides education in the methodology utilized by CT Partners which provides more opportunity for overcoming skill deficiencies.

Cap Gemini

There are currently needs for more software development skills due to the variety of tools, languages, databases, operating systems, and other systems and application software in use for workstations as well as other platforms. CGA as well as other SI and professional services firms can not count on having the skills available that prospects and clients have in use or plan to utilize. Alliances, temporary staff members and the services of specialized temporary employment services must be used.

Skills bottlenecks are being encountered. CGA will propose changes in the software products planned or specified for jobs by users. Recently, one client was persuaded to step back to an earlier version of a workstation operating system in order to use the network manager which had been selected.

In addition to proposing changes to the set of software products selected for a project, the proactive step more often taken by CGA is to work with clients and recommend a set of products that can be well supported.

Internal education as well as relations with consultants and other firms are also sought to expand the skills inventory that CGA can support.

DACOM

Finding people who understand business processes is their greatest need. It takes several years to train a new employee with little business experience (largely on the job). They can predict fairly well the people who will not ultimately make it, after a day of pre-qualification testing; however, they can only predict those who will not fail; they are much less sure of those who will do very well. They have often been forced to hire more senior people as a result; this kind of person is more expensive, pound for pound, than a more junior person. A larger problem is that it is more difficult to form a cohesive "DACOM way" from people who are more set in their ways (even if these are sound, productive ways).

DACOM would like to emulate the philosophy of an EDS or Andersen and mold new recruits to their culture.

Digital Equipment

There are a number of new skills that are needed in current projects ranging from those needed to use new systems development and relational database tools to those available to use network software products, GUI and workstation spreadsheet and database products.

The new skills are not always present at DEC. Some internal training is carried on and external training is made use of. However, a group of contract services vendors are used to meet critical situations with temporary people. VARs and associated consultants are also used to meet critical needs.

Hewlett-Packard

Technical skills don't seem to be a problem for HP. The company's culture supports investing in employees, particularly in technical education. Project management is the primary area where they see a significant shortage. And, there are no magic wands to wave that eliminate the need for the "experience" factor in project management. They are trying an "understudy" approach which pairs less experienced project managers with more experienced ones to hopefully obtain knowledge transfer.

IBM Corporation

Skills are still in short supply and distributed unevenly. Hiring restrictions and staff reductions have made it difficult to get the right people. The IBM culture still places great emphasis on training. Proactive steps to improve the situation include arrangements with vendors that can aid with or participate in improvement in software building.

Oracle

Oracle, being a technology company, makes heavy investments in training, and provides numerous incentives for self-development. On-going training and development is just part of the culture. So fundamentally, Oracle doesn't feel that it's facing a any significant problém in finding or developing the skills that it needs.

In general, Oracle sees the distribution of IS skills to user organizations is a significant change, and will continue to happen throughout the decade. In terms of skills bottlenecks, Oracle believes that these are largely transient effects.

Cambridge Technology

Users are being brought in to systems testing more, particularly to review the systems concept or business re-engineering envisioned. The methodology of CT Partners is supportive of this by enabling users to formulate requirements in a structured manner and test out the system approach more quickly through the rapid generation of a prototype.

Cap Gemini

More comprehensive tests are formulated with the aid of users, and users are brought into the review of proposed systems at an earlier stage through the use of front end CASE tools and JAD or RAD types of processes.

DACOM

Testing should be done at the model level.

Digital Equipment

Efforts are being made at Digital to develop new types of testing that will be automatically incorporated into the system building process.

There are also some products being introduced jointly with large companies that will handle portions of the testing process in new ways through system review with front end CASE tools, prototyping and other means.

Hewlett-Packard

Adoption of the C/S model has significantly changed (and improved) the testing process. (See the answer to question 5.) Since the modes provides for a limited set of structured communications between client and server using standard protocols, it's possible to develop test packages to automate the testing of each units functionality separately and in most instances simultaneously. This has lowered testing costs and cycle times significantly.

IBM Corporation

Users are being brought in to systems testing to a greater extent. New types of tools or systems review are being sought to improve the ability of users to test systems. Where vendors are involved in the supply of or development of software products, more accountability is being placed upon them during systems testing.

Oracle

Testing is becoming an on-going continuous process. The objective is no longer just to meet a written specification, but to insure that the customer is satisfied with the cost, functional performance and time to delivery of the system. In a sense this increases the complexity of the entire testing process, and places the "pass fail" judgment directly to the user.

In terms of actually testing finished code, major tests are built in at each of the three major phases of the Oracle process (rapid prototyping, refinement, integration).

The process of regression testing of software is growing more complex. As more and more functionality is included, the possibilities that need to be tested multiply exponentially. Some automated processes have been put in place, but manual testing of individual products is still required.

Particular Innovations

Cambridge Technology

CT Partner's believes its methodology (described in section 1) is particularly innovative.

CT Partner's also feels that its ability to rapidly develop strategic systems using an open system approach is innovative.

Cap Gemini

The effort to use the software engineering tools and concepts of leading software engineering firms together with the experience of CGA is felt to be innovative. Some other SI/professional services firms concentrate on using their own tools and methodologies. CGA wants to incorporate the ideas of firms who specialize in improving the software building process.

Position papers and internal training ensures that innovations are spread throughout CGA. CGA is prepared to work with clients to help them speed innovative changes in systems building, but this can be difficult to achieve in large organizations, since many user groups are acting independently.

DACOM

DACOM believes that their entire approach is innovative, i.e.,

- Emphasizing modeling the upstream business process and defining objectives

- Focus on model building

- Making customer part of team, involving high levels of education and training

- De-emphasize conventional "software building" part of the equation (even though many of the DACOM staff has a heavy background in software building).

Digital Equipment

Digital feels that its system building process is innovative since it results in complex network solutions in a relatively short time.

Several recent internal efforts have resulted in factory-like development of code, but can't be discussed yet.

Hewlett-Packard

They believe that there is significant variation between major firms, but that probably all leading firms have hot spots where advances are being made. Several user companies and two vendors were cited.

- Dupont - Significant work in "rapid" prototyping for C/S applications

- Farmers' Insurance - Advanced architecture for C/S transaction management

- Microsoft - Use of advanced tools and concepts (object oriented coding, etc.) to automate the systems building process. Reusability at applications product level.

- HP - C/S applications model and transaction management

- Andersen - Re-engineering process and (probably) reusable applications modules.

IBM Corporation

Innovation of various types is being tried by corporations in contact with IBM including the development of specialized tools internally or by vendors, the generation of objects in C++ code that can be used to add necessary functions to a number of systems, the use of specialized CASE approaches, greater reliance on vendor application software products and experimentation with new types of languages. One effort that IBM is engage in with a user involves the use of specialized GUI that aid a developer to combine objects. Use of the GUI will guide (and force) the developer to include various types of controls and aids that will facilitate testing and operation of the resulting system.

IBM is also conducting research on ideas about GUI that use symbols other than icons. One of these concerns the use of symbols that would aid a person involved in a work group structure.

Oracle

- More and more integration of applications systems and data

- Installing methodologies which permit the continuous refinement of systems

- Providing tools and methodologies which allow users to achieve high levels of self-sufficiency in terms of managing their own systems environment.

Cost of Making Improvements in Systems Building

(Funds, People, and Opportunities Foregone)

Cambridge Technology

Cambridge Technology has experience in relation to this topic. It originally sold education that concentrated on using technology to obtain competitive advantage. The cost of implementing the methods it advocated were hard to justify in many organizations. It was easier for these organizations to pay for the use of the methods to implement strategic applications more rapidly. A near term payoff on a project justified using the methods.

Since the current process is so controlled, the cost of making improvements to it can be evaluated in terms of both near and longer term benefits. No changes are foreseen that would change the process to a significant extent.

Cap Gemini

Improvements in systems building within CGA takes time and consume funds and personnel, and can delay getting work done and limit or preclude taking advantage of business opportunities. That is why CGA tries to use the experience of business partners active in systems development processes and tools as well as experiment with methods that might improve systems development. CGA wants to be able to work with clients that want to use various improvements, even if temporary consultants are employed to aid with that; however, CGA wants to limit internal changes unless there are longer term advantages. .

DACOM

High costs, both to themselves and their customers. [A strength and weakness of DACOM is the fuzzy line between themselves and their customers.] DACOM has plowed back a great deal of time and money into iterations of their approach. They believe that they are on a very productive path now. But the whole process has definitely been a long term investment for them.

Digital Equipment

It is hoped that there will be some rapid or near term improvements although most observers at DEC feel that it will be a long term investment.

Hewlett-Packard

The following is HP's educated guess:

- In addition to whatever investment cost their might be in designing a new process or technique, the first time the process is put into use on an actual systems effort, there is probably a twenty percent penalty in development cost.

- On the second attempt the penalty probably drops to 10% and on future efforts gains in productivity can be made in the order of 10-20% per effort.

To pull together HP's C/S model probably cost between $500K and $1M. This doesn't count the many hours that were invested in developing stand alone components which were used in the model. However, benefits are there from the developers viewpoint.

After two years of working with the model in actual development efforts, they are probably delivering systems at 80% of the cost for these same systems developed using conventional methods.

IBM Corporation

The cost of making improvements can not be tracked on an overall basis in IBM and is not being tracked in most organizations. IBM is willing to make improvements to obtain near term business or to improve capabilities over a longer term. It is felt that many short term efforts should be undertaken in order to ensure that IBM will be aware of the more outstanding improvements.

Oracle

Unfortunately this is something that isn't measured. Partly because what is being done is intertwined with so many other activities, it's not clear that even a heavy investment in the measurement process would produce a result of significant value. However, major investments in new methodologies and tools were looked upon by users as long term investments. Only when the first applications came rolling out under the new approach would people begin to realize the potential savings or pay back.

Success/Failures

Cambridge Technology

The use of the rapid prototyping technique to review system approaches and how systems will work has helped CT Partner's avoid real failures. Past experience has taught the organization that its methods must be adhered to in order to guaranty benefits.

Cap Gemini

CGA tries to avoid failures in using new systems building methods by working with business partners who are developing and testing out the methods.

DACOM

There were several major failures in business concept and execution in the mid-1980s.

- They were overly product oriented

- They did not sufficiently value or leverage their "wisdom" in the past from a business standpoint

Digital Equipment

There have been difficulties encountered, but failures have not been recorded or won't be discussed.

Hewlett-Packard

The C/S development model has been Hp's biggest success. On the failure side, early on they had an occasional disaster in terms of actually using the model to do a client implementation.

IBM Corporation

Failures or the inability to achieve total objectives has been notable in some CASE projects as well as projects run by IBM that were supposed to improve software building. A major lesson that was learned was that the business objectives and processes are sometimes neglected or not reviewed sufficiently and rethought during projects that automate systems building.

Oracle

It's no secret that Oracle's biggest failure was in its initial approach to the applications software market. The products (originally developed for internal use) were low in quality and functionality, support was low quality, and sales commitments exceeded the deliverable capability. This problem is behind them now, and caused a major rethinking about the entire applications building process which forced Oracle into its new direction - with benefits all around.

Other Organizations to Watch

Cambridge Technology

A number of systems integrators are improving their ability to build systems, but no one has taken the steps that CT Partners has to both speed up development and review a model of the business system before it is delivered.

Texas Instruments as well as Andersen are known for efforts to improve systems building.

Cap Gemini

Leading systems integrators such as big 6 firms and CSC are always trying to improve their ability to build systems. Andersen Consulting stands out as a firm that they believe has achieved improvements.

DACOM

James Martin Associates are doing good work. Otherwise, they admit to being inward-looking and do not "follow the competition". To some extent this is because they do not see most other vendors as being in the same kind of business as they are. That is, vendors that are working on software development improvements are not viewed as having many lessons for them. They view most other "business process re-eningeering" vendors as being much more touchy-feely (or management consulting oriented). But they admit that they may be wrong.

Digital Equipment

These range from organizations concerned with improvements such as James Martin & Associates and KnowledgeWare to vendors such as Andersen Consulting and Cambridge Technology. Andersen has a methodology and tools that have been demonstrated on a number of projects.

Hewlett-Packard

HP is probably ahead of the average firm in rethinking and actually implementing changes to the software building process. They believe they were probably far from the head of the pack. They don't think that there was any one firm who was the leader in all aspects of the process.

IBM Corporation

The vendor mentioned most often as one who is or may be achieving such improvements is Microsoft. They have been building and rebuilding software objects so that they can be joined together more easily. Visible Basic has been improved and re-coded in C++ to provide users the means of reviewing and adding to or modifying objects in a more easy fashion. The Next operating system of Jobs was felt to be a good step in the direction of improved development, but is not spoken of lately. Products such as Powerbuilder and the Insynch Passport system that generates C code are also being reviewed in addition to the products of TI, KnowledgeWare, Bachman and others whose products are under constant review.

Oracle

Some significant improvements are being made in the pharmaceutical industry. (Examples which confidential.) There are similar developments in the chemical where the adoption of new techniques and approaches to systems is allowing high levels of integration improving overall productivity to the firm.

Charging for Higher Value Software Assets

Cambridge Technology

A systems integrator can obtain recognition and sufficient remuneration, particularly when steps such as the use of a rapid prototype are used. It might be hard to translate this process into building software products that commanded a premium price over other software products however since it could be hard to convince buyers that products offered a competitive advantage that would command a much higher price. Competitors would claim that they had something almost as good at a much lower price.

Cap Gemini

The total value of the assets can only be measured over time, although there may be more immediate benefits such as more rapid and less cost development or easier testing.

A systems integrator such as CGA can obtain recognition and remuneration based on the ability of delivering a solution. It might be necessary to establish a long term relationship to gain additional payment for delivering higher quality assets that would facilitate systems modification and growth for instance.

DACOM

They do not believe that their "consumers" are sufficiently educated to understand the issues involved. This goes back to the hard data question: If vendors (including themselves) could better demonstrate that this was true, then perhaps customers would pay more. They see this involving a long process of education and culture change -- 5 or 10 years at least -- before (a) This becomes true and (b) customers will accept it as being true.

Digital Equipment

Not sure how it can be measured and recognized, except over a period of time.

It will be necessary to guaranty the higher value in some way, if users are asked to pay more.

Hewlett-Packard

HP doesn't feel that the asset value of individual custom designed systems will improve significantly as the direct result of improvements to the process; but does believe that the process will create new kinds of assets.

The business process models developed as a result of re-engineering can and (in a few instances) are being sold or brokered. Repositories of basic business processes will one day be sold. Using these models through a medium such as IEF, other firms could tailor both the processes and the code to meet their particular business needs. One example cited was an airline used TI to broker its IEF model for frequent flyer operations to another airline serving a non-competitive market.

IBM Corporation

Although it is believed that higher value software assets will be developed, there are unanswered questions about the ability of a vendor to achieve sufficient recognition for the software assets put in place so that a premium can be charged on a near term basis.

Oracle

The actual asset value of software will probably go down as it becomes easier to build and is replaced more quickly. However, the value of the "information asset" will likely rise significantly as newer applications and software systems permit its distribution, collection and utilization in ways that weren't previously possible. Whether anyone can measure these values is debatable.

CHAPTER V:

Summary By Vendor

1.   Changes in the Software Building Process (Overall)

They have introduced changes to bring about more rapid development and will add to or refine them in the future. They have speeded up the development process or time to develop an important or strategic application system by a factor of 3 (time to completion and use of the system) compared to similar projects at a client or other company where traditional methodologies or even some newer methods were used. (This appears to be so, but is based on using people with considerable knowledge and experience employed who impose a methodology that forces higher level user executives to provide timely and meaningful contributions to the process.)

The process allows the cost of the software building process to be reduced (including the person months involved) and the quality to be increased.

The development technique includes a well planned and executed preliminary requirements definition, rapid systems prototyping methodology to pin down requirements and parallel development teams to implement the system. (Top user executives are forced to provide timely and dedicated reviews of the results of the prototype through the activities of CT.)

2.   Soft Benefits

The use of rapid prototyping during the requirements definition helps to improve communication about requirements as well as to analyze what is going on in business processes. If business systems are being re-engineered, concepts can be tested out. The prototype software enables users to review systems and gives them a feeling of satisfaction with the final implementation.

3.   Relative Contribution of Tools and Processes

Both tools and processes are used in the CT Partners methodology. The rapid prototyping capability is more of a tool-like technique that allows concepts to be tested.

The development of the implementation code by the use of parallel teams is more of a process or factory like method in which one team handles the application, a second handles connectivity, a third the user interface, and a fourth the data.

4.   Reusability

The methodology described above has not focused on reusability, but the use of parallel development efforts would facilitate the consideration of reusable code since functional aspects of coding are separated.

5.   Difficulties in Addressing Client/Server

There can be difficulties since corporate objectives as well as processes and data can be divided between uncoordinated systems on client/servers. Cambridge Technology allows client/server systems to be handled by themselves or better yet, together with other, related systems changes that are necessary to meet corporate goals. The methodology utilizes open systems which facilitates work with a variety of client/server technology.

They also test out application approaches with rapid prototyping that should highlight questions about the segmentation of functions and data across systems.

6.   Is More Than One Process Model to Improve Systems Building?

CT Partners uses only one process model, although improvements to it are considered, evaluated and implemented over time. They have a high degree of control over management of change.

7.   Skill Needs and Distribution

Higher level skills are in short supply and distributed unevenly. CT Partners provides a method that allows the need for skills to be managed and controlled more easily.

The CT Group, an affiliated organization, provides education in the methodology utilized by CT Partners which provides more opportunity for overcoming skill deficiencies.

8.   System Testing Process

Users are being brought in to systems testing more, particularly to review the systems concept or business re-engineering envisioned. The methodology of CT Partners is supportive of this by enabling users to formulate requirements in a structured manner and test out the system approach more quickly through the rapid generation of a prototype.

9.   Particular Innovations

CT Partner's believes its methodology (described in section 1) is particularly innovative.

CT Partner's also feels that its ability to rapidly develop strategic systems using an open system approach is innovative.

10. **Cost of Making Improvements in Systems Building (Funds, People, and Opportunities Foregone)**

Cambridge Technology has experience in relation to this topic. It originally sold education that concentrated on using technology to obtain competitive advantage. The cost of implementing the methods it advocated were hard to justify in many organizations. It was easier for these organizations to pay for the use of the methods to implement strategic applications more rapidly. A near term payoff on a project justified using the methods.

Since the current process is so controlled, the cost of making improvements to it can be evaluated in terms of both near and longer term benefits. No changes are foreseen that would change the process to a significant extent.

11. **Success/Failures**

The use of the rapid prototyping technique to review system approaches and how systems will work has helped CT Partner's avoid real failures. Past experience has taught the organization that its methods must be adhered to in order to guaranty benefits.

12. **Other Organizations to Watch**

A number of systems integrators are improving their ability to build systems, but no one has taken the steps that CT Partners has to both speed up development and review a model of the business system before it is delivered.

Texas Instruments as well as Andersen are known for efforts to improve systems building.

13. **Charging for Higher Value Software Assets**

A systems integrator can obtain recognition and sufficient remuneration, particularly when steps such as the use of a rapid prototype are used. It might be hard to translate this process into building software products that commanded a premium price over other software products however since it could be hard to convince buyers that products offered a competitive advantage that would command a much higher price. Competitors would claim that they had something almost as good at a much lower price.

1.   Changes in the Software Building Process (Overall)

They have ongoing programs concerned with improving the software building process, although their main concern is satisfying the needs of clients in specifying, delivering and installing business systems. They focus attention about improvements in the software building process on activities of software engineering firms such as Intersolv and Bachman who have been business partners.

Changes in the process which would speed up the development of business solutions, increase quality and/or reduce costs could increase competitiveness and be important to us. Improvements are being obtained on a regular basis, but they would like to see a substantial or notable change that could reduce the time for large, complex projects by 25% or more. This would gain attention from clients and prospects. However, control of change to their process is most important.

2.   Soft Benefits

Improvements in software building should include steps to aid users to review how business processes will be changed or re-engineered as well as to review data management and utilization. Improvements in software engineering tools have aided both of these objectives.

3.   Relative Contribution of Tools and Processes

As noted above, tools have brought ongoing improvements in the software building process, but changes in the overall process have made the greatest impact on their ability to deliver timely and quality work, and we would like to see an improvement in the process that would provide a substantial improvement in time and cost requirements while also enhancing quality further.

They are reviewing the use of factory-like methods to generate code although most of the effort is devoted to working with users and difficulties could occur in trying to implement a factory process in that situation.

4.   Reusability

Cap Gemini and its business partners are exploring the use of reusability of objects as well as object oriented programming, but this is one of many efforts to improve methods.

5.   Difficulties in Addressing Client/Server

The needs of users have to be fully understood before decisions are made regarding the technology that will be used in a solution. Decisions are made too quickly in regard to the use of client/server technology, and problems can result in relation to data management and the division of functions between business units.

6.   Is More Than One Process Model to Improve Systems Building?

Within CGA, there is an effort to use one model although experimentation is made with other models. We are willing to support projects at users that employ models different from the one we support internally. Some individual offices or personnel are attempting to change methods, but control is achieved. They have a medium-high degree of control over the management of change.

Due to uncertainties about the systems building process as well as the lack of coordination between various department in a company, multiple models may be in use at a client, and they might be involved in supporting more than one.

7.   Skill Needs and Distribution

There are currently needs for more software development skills due to the variety of tools, languages, databases, operating systems, and other systems and application software in use for workstations as well as other platforms. CGA as well as other SI and professional services firms can not count on having the skills available that prospects and clients have in use or plan to utilize. Alliances, temporary staff members and the services of specialized temporary employment services must be used.

Skills bottlenecks are being encountered. CGA will propose changes in the software products planned or specified for jobs by users. Recently, one client was persuaded to step back to an earlier version of a workstation operating system in order to use the network manager which had been selected.

In addition to proposing changes to the set of software products selected for a project, the proactive step more often taken by CGA is to work with clients and recommend a set of products that can be well supported.

Internal education as well as relations with consultants and other firms are also sought to expand the skills inventory that CGA can support.

8.   System Testing Process

More comprehensive tests are formulated with the aid of users, and users are brought into the review of proposed systems at an earlier stage through the use of front end CASE tools and JAD or RAD types of processes.

9. Particular Innovations

The effort to use the software engineering tools and concepts of leading software engineering firms together with the experience of CGA is felt to be innovative. Some other SI/professional services firms concentrate on using their own tools and methodologies. CGA wants to incorporate the ideas of firms who specialize in improving the software building process.

Position papers and internal training ensures that innovations are spread throughout CGA. CGA is prepared to work with clients to help them speed innovative changes in systems building, but this can be difficult to achieve in large organizations, since many user groups are acting independently.

10. Cost of Making Improvements in Systems Building (Funds, People, and Opportunities Foregone)

Improvements in systems building within CGA takes time and consume funds and personnel, and can delay getting work done and limit or preclude taking advantage of business opportunities. That is why CGA tries to use the experience of business partners active in systems development processes and tools as well as experiment with methods that might improve systems development. CGA wants to be able to work with clients that want to use various improvements, even if temporary consultants are employed to aid with that; however, CGA wants to limit internal changes unless there are longer term advantages. .

11. Success/Failures

CGA tries to avoid failures in using new systems building methods by working with business partners who are developing and testing out the methods.

12. Other Organizations to Watch

Leading systems integrators such as big 6 firms and CSC are always trying to improve their ability to build systems. Andersen Consulting stands out as a firm that they believe has achieved improvements.

13. Charging for Higher Value Software Assets

The total value of the assets can only be measured over time, although there may be more immediate benefits such as more rapid and less cost development or easier testing.

A systems integrator such as CGA can obtain recognition and remuneration based on the ability of delivering a solution. It might be necessary to establish a long term relationship to gain additional payment for delivering higher quality assets that would facilitate systems modification and growth for instance.

D. APPLETON COMPANY (DACOM)

1. Changes in the Software Building Process (Overall)

The current approaches, especially CASE, haven't just reached a dead end but have lead us down the wrong dead end: The problem isn't producing code efficiently and correctly, but designing the right systems in the first place.

DACOM began as a CASE-oriented, essentially product, company in the early 1980s. It built reasonably good tools and was (and is) a leader in repository thinking. However, over time DACOM saw that the chief need was for an understanding of business processes and making improvements in the systems which support business processes.

DACOM has evolved from a company with an emphasis on software building to one that works closely with clients to design the right system in the first place. Software "implementation" is viewed by DACOM as almost easy once the underlying business design is set.

Overall time to complete may or may not be shorter compared to conventional methods. Much depends on how well their clients have been educated in the DACOM method. Initial projects are usually slower because of education and cultural change. Subsequent projects are probably shorter; however, this is very difficult to measure since historical measures of time to complete don't do justice to the time spent on the up-front business engineering phase.

Actual software development is much faster after DACOM's work:

• There are relatively few downstream changes

• The "specs" are unambiguous

Quality is immeasurably higher, although, again, there are few benchmarks and measuring methodologies for quality. This is very frustrating for DACOM because they and their clients strongly believe this to be true, but it is very difficult to prove. Other vendors make similar claims -- which DACOM doubts are true -- and DACOM's real achievements (to them) get lost in the general noise level.

DACOM admits that they could do a much better job at quantifying benefits, in order to

• Measure their own progress

• Assess the relative strengths of different approaches

• Market themselves better

Right now, too much of their acceptance is based on clients buying into the DACOM "religion". This is ironic and frustrating for an organization that views itself as a rigorous, engineering-oriented company.

2.   Soft Benefits

DACOM would take issue with the concept of "softer" benefits. The benefits are softer only from the standpoint that many (maybe most) of the benefits do not accrue to software building, but are gained by the underlying business. (DACOM agrees that it would be very powerful to measure the "before" and "after" business costs and benefits, but it does not do so on a consistent basis. Its clients don't want to pay for this kind of activity, because doing so won't help solve their particular business problem.}

DACOM works largely with true end users in the manufacturing/logistics area. From the standpoint of DACOM's clients the current system building process is "intolerable" and not just for the usual reasons of lateness and expense. The more thoughtful clients (and DACOM appeals to thoughtful clients, for better or worse) are frustrated by software that

- Doesn't meet their business functional needs very well.

- Behaves in inconsistent and unpredictable ways; users are overwhelmed by system details; computer systems make it harder rather than easier to understand underlying problems.

- Is difficult to change in the terms of time and expense and, even then, often can't really be changed to meet user needs

Downsizing of organizations and of the computing environment multiplies these problems

Their clients don't really care about the usual measures used to measure a "good" software project.

3.   Relative Contribution of Tools and Processes

DACOM has a full perspective, having started as a CASE company (before the term was invented) and now describe themselves as a "systems integration consultant."

DACOM does use tools, some of which are their own (see attachment 1).

However, they see tools as essentially supporting a model-oriented approach ("Tools are the finger painting of business engineering").

- They see almost all CASE tools as not supporting the improvement of business processes (although pieces of them can do so with the right orientation)

- A good repository is vital, but they don't know of one that really meets their needs.

- They are forced to use and link standalone tools. They hope that in the future there will be integrated tools that will support a range of modeling techniques.

A key component (and bottleneck) is the need for consultants with the necessary "wisdom" to integrate the business problem, modeling techniques and client change. This is the strength of their business, but also a key limitation.

- These traits make them valuable to customers, but expensive.

- DACOM would like to be able to leverage this knowledge in a more embedded methodology. They see the application of AI and fuzzy logic as possibilities, but are currently resource-constrained in being able to pursue these directions very aggressively. (They are especially cautious since in the past they have tried to prematurely productize processes.)

The general process that they use is shown in Attachment 2.

4. Reusability

They are attracted to the concept of reusability but have found only a small number of "paradigm processes" which they can see as potential candidates. For example, "inventory" should qualify, but doesn't once the major differences between industries are examined as well as the "flavors" between firms.

They see no theory of reusability in the commercial world (unlike the formulas in the scientific world) to make their job easier. They use common skeletons and analyze differences but don't really view this as reusability.

They reuse "wisdom" and are aware of the deficiencies in doing so.

5. Difficulties in Addressing Client/Server

The client/server model is extremely incomplete. More basically, there is no model for organizational or functional downsizing. This puts a process engineering in a double bind. Learning for DACOM is "painful" and largely intuitive as far as where data, processing and location boundaries are drawn.

This disturbs them less than may appear, since the analytic process involved in understanding the business processes will usually keep them from making unrecoverable mistakes in "client" and "server" function allocations.

They feel great sympathy with their partners (whether customer-partners or vendor-partners) who are trying to make client/server technology work.

6. Is More Than One Process Model To Improve Systems Building?

They have their own approach (attachment 2). However, they feel agnostic toward particular business analysis practices and feel it is too early to back one horse. They have a high degree of control over the management of change.

7. Skill Needs and Distribution

Finding people who understand business processes is their greatest need. It takes several years to train a new employee with little business experience (largely on the job). They can predict fairly well the people who will not ultimately make it, after a day of pre-qualification testing; however, they can only predict those who will not fail; they are much less sure of those who will do very well. They have often been forced to hire more senior people as a result; this kind of person is more expensive, pound for pound, than a more junior person. A larger problem is that it is more difficult to form a cohesive "DACOM way" from people who are more set in their ways (even if these are sound, productive ways).

DACOM would like to emulate the philosophy of an EDS or Andersen and mold new recruits to their culture.

8. System Testing Process

Testing should be done at the model level.

9. Particular Innovations

DACOM believes that their entire approach is innovative, i.e.,

- Emphasizing modeling the upstream business process and defining objectives

- Focus on model building

- Making customer part of team, involving high levels of education and training

- De-emphasize conventional "software building" part of the equation (even though many of the DACOM staff has a heavy background in software building).

10. Cost of Making Improvements in Systems Building (Funds, People, Opportunities Foregone)

High costs, both to themselves and their customers. [A strength and weakness of DACOM is the fuzzy line between themselves and their customers.] DACOM has plowed back a great deal of time and money into iterations of their approach. They believe that they are on a very productive path now. But the whole process has definitely been a long term investment for them.

11.   Success/Failures

There were several major failures in business concept and execution in the mid-1980s.

- They were overly product oriented

- They did not sufficiently value or leverage their "wisdom" in the past from a business standpoint

12.   Other Organizations to Watch

James Martin Associates are doing good work. Otherwise, they admit to being inward-looking and do not "follow the competition". To some extent this is because they do not see most other vendors as being in the same kind of business as they are. That is, vendors that are working on <u>software</u> development improvements are not viewed as having many lessons for them. They view most other "business process re-eningeering" vendors as being much more touchy-feely (or management consulting oriented). But they admit that they may be wrong.

13.   Charging for Higher Value Software Assets

They do not believe that their "consumers" are sufficiently educated to understand the issues involved. This goes back to the hard data question: If vendors (including themselves) could better demonstrate that this was true, then perhaps customers would pay more. They see this involving a long process of education and culture change -- 5 or 10 years at least -- before (a) This becomes true and (b) customers will accept it as being true.

Digital Equipment Corporation

1. Changes in the Software Building Process (Overall)

Changes are being considered or made to speed up the development of software as well as to reduce its cost and improve quality. Many separate activities are taking place ranging from steps in consulting and systems planning to work at all levels with tools and methodologies. Specific goals have not been quantified or can't be discussed, but it seems that the speedup being sought at this time would reduce development time by one third on larger projects.

2. Soft Benefits

There is a definite need to achieve other, softer benefits for customers including improved satisfaction with the development process, improved communications on the work being done, and more ability to respond to needs. These needs are being investigated in relation to systems integration and professional services work as well as in relation to internal analyses of systems building.

3. Relative Contribution of Tools and Processes

Tools including CASE tools and other software aids are being sought and evaluated to aid with the system building process. Tools may seem to be more important in regard to current improvements in systems building, but improvement of the entire process that is carried out in systems building offers more opportunities for improvement.

The use of techniques such as JAD or RAD as part of a process are expected to have more impact on time, cost and quality than tools can.

Research is being conducted that addresses both the use of tools and processes to improve the system building process. The use of manufacturing techniques in software production has been carried out and is also being investigated together with other topics.

4. Reusability

Tools are being used that allow a repeatable solution to be sold. For certain applications, these tools will allow the solution to be modified or customized more easily, and many components of the solution would not have to be changed. There have been various types of reusability in the past by DEC VARs as well as by DEC. Digital has also been experimenting with reusing objects in a group of internal projects and is now doing that on a regular basis

5. Difficulties in Addressing Client/Server

There are questions about the allocation of data and processes from a consolidated system to a number of client/server systems. There are also questions about using a set of data or transactions received at one point to update multiple client/server systems.

6. Is More Than One Process Model to Improve Systems Building?

DEC is using multiple process models, but most of these efforts are coordinated. In some circumstances, activities in support of accounts could use tools and techniques or new methodologies in an unplanned manner to improve systems building. Where a VAR or associated vendor is in a lead position, this is particularly true. They have a medium degree o control over the management of change.

Tools are available to help manage or control change management at DEC, but they are not always used.

7. Skill Needs and Distribution

There are a number of new skills that are needed in current projects ranging from those needed to use new systems development and relational database tools to those available to use network software products, GUI and workstation spreadsheet and database products.

The new skills are not always present at DEC. Some internal training is carried on and external training is made use of. However, a group of contract services vendors are used to meet critical situations with temporary people. VARs and associated consultants are also used to meet critical needs.

8. System Testing Process

Efforts are being made at Digital to develop new types of testing that will be automatically incorporated into the system building process.

There are also some products being introduced jointly with large companies that will handle portions of the testing process in new ways through system review with front end CASE tools, prototyping and other means.

9. Particular Innovations

Digital feels that its system building process is innovative since it results in complex network solutions in a relatively short time.

Several recent internal efforts have resulted in factory-like development of code, but can't be discussed yet.

10. **Cost of Making Improvements in Systems Building (Funds, People, and Opportunities Foregone)**

It is hoped that there will be some rapid or near term improvements although most observers at DEC feel that it will be a long term investment.

11. **Success/Failures**

There have been difficulties encountered, but failures have not been recorded or won't be discussed.

12. **Other Organizations to Watch**

These range from organizations concerned with improvements such as James Martin & Associates and KnowledgeWare to vendors such as Andersen Consulting and Cambridge Technology. Andersen has a methodology and tools that have been demonstrated on a number of projects.

13. **Charging for Higher Value Software Assets**

Not sure how it can be measured and recognized, except over a period of time.

It will be necessary to guaranty the higher value in some way, if users are asked to pay more.

1.   Changes in the Software Building Process (Overall)

The driving force behind changes in the systems building process at HP is to reduce the time required to deliver projects while improving the overall quality of the finished product. HP's area of emphasis is on the management process for building systems, not on tools. They are placing emphasis on the re-engineering aspects of the business process, and simultaneously trying to develop a methodology which will apply a rigorous discipline to the resulting systems implementation.

They do believe that tools are important. However, they believe that 90% of the errors occurred at the front end, where few tools are of much use without an overall re-engineering of the business process.

They believe that their emphasis on re-engineering focusing on downsizing, organizational changes, process re-design within reasonable cost containment guidelines of the client, is the primary thrust of their rethinking of the systems development process.

Reduced cycle time on the completion of business systems re-engineering project, including the generation of finished applications systems - 25%. They would not give a specific example.

HP is trying to define quality as "fit to business need" within the client's anticipated time frame. Their position is that counting bugs in the code is secondary.

HP has not made much progress on reusability. Reusability per se is not a goal. Studies that they've conducted indicate that there is huge waste in the current process which could be significantly reduced if a set of standards could be developed along with a process to better manage code; identify and select modules to be developed and maintained as "reusable", etc. However, they feel that the process is a long way off.

The main problem is that in order to generate reusable modules, the development process must be integrated or contain components and standards which insure reusability. They think that most firms are farther behind in this area than they are in CASE. (In HP's view, most firms aren't very far along in the effective integration of CASE into the development process.)

Very little is being done to obtain any more meaningful quantification of benefits than was done in the past. This process becomes even more complex when significant business re-engineering is involved. In some instances various components could be readily quantified, but that inmost instances where business investment on the basis of much softer criteria.

2. Soft Benefits

HP's experience has been that the two dominant soft benefits that firms are using to justify re-systemization (and business re-engineering) efforts are:

• Improved customer satisfaction; and

• Reduced cycle time on core business transactions

Certain of HP's customers have taken to trying to measure both of these factors; but it's still difficult to relate the measures to the bottom line performance of the firm.

3. Relative Contribution of Tools and Processes

HP believes that the biggest contributions are coming through improvements in the process and people management aspects of the systems building process. CASE tools and other automated approaches are important but secondary. They have adopted an approach which pairs top-flight project managers with tailored teams for specific implementations. Project managers are responsible for projects only. Team members are managed in the personnel and development sense by other managers within their home organizations.

• They have installed new processes that permit feedback between project managers and those managers in the firm who are responsible for the development and administration of individuals within the organization.

• They have installed a special program to continually improve even seasoned project managers skills.

• They are using some incentive programs for project performance and quality on an experimental basis, but these programs are immature in that they tend to reward heroic fire fighting efforts...rather than solid fire prevention on a day to day basis. Incentives (both team and individual will probably play a stronger role in the future.

4. Reusability

Very little is being done by HP in the reusability concept as applied to custom code development. However, a significant amount of work is going into refining process which will insure reusability of some significant portion of the code that's developed for applications or systems software products.

What is being done in this area is proprietary to HP and its products. They are still a long way from the point where the generation of "universal objects", etc. will be commonplace

5.   Difficulties in Addressing Client/Server

HP has been working at the C/S model in an open systems environment for some number of years. They are very comfortable with it at this point, and have a formally documented approach for allocating functions and data between clients and servers. (As is the case with reusability, the model is proprietary to HP and might not be applicable to other platform architectures.) The model is supposed to be rigorous and has significantly improved the quality and efficiency with which new applications can be developing using C/S.

They still needed to improve the overall process at the design level. The area that needs the greatest improvement is a consistent approach to linking redesigned business processes with functional specifications for C/S systems. They are working on this.

*   They have just dropped KnowledgeWare in favor of IEF as their primary CASE vendor.

*   Anticipate that IEF organization will work jointly with them on tailoring CASE tools to meet HP's needs both at the design and implementation levels.

A formal model for the C/S design process has significantly improved the quality and reduced the time required to systematically test new code. Estimates that they are saving about 20-25% in this area, and are certain that the quality of the code is higher.

6.   Is More Than One Process Model to Improve Systems Building?

HP is definitely trying multiple approaches to improving the systems building process, but the process is not seen internally as very well coordinated. Individual initiatives appear to pop up, and get piloted. Informal communications between people involved in these efforts are the primary method of coordination. However, enough information gets shared to insure that some "best of breed" approaches are emerging.

There is a group manager whose responsibility it is to gather, digest and redistribute information on the new techniques and approaches that emerge. Overall, they have a medium to low degree of control over the management of change.

7.   Skill Needs and Distribution

Technical skills don't seem to be a problem for HP. The company's culture supports investing in employees, particularly in technical education. Project management is the primary area where they see a significant shortage. And, there are no magic wands to wave that eliminate the need for the "experience" factor in project management. They are trying an "understudy" approach which pairs less experienced project managers with more experienced ones to hopefully obtain knowledge transfer.

8. System Testing Process

Adoption of the C/S model has significantly changed (and improved) the testing process. (See the answer to question 5.) Since the modes provides for a limited set of structured communications between client and server using standard protocols, it's possible to develop test packages to automate the testing of each units functionality separately and in most instances simultaneously. This has lowered testing costs and cycle times significantly.

9. Particular Innovations

They believe that there is significant variation between major firms, but that probably all leading firms have hot spots where advances are being made. Several user companies and two vendors were cited.

- Dupont - Significant work in "rapid" prototyping for C/S applications

- Farmers' Insurance - Advanced architecture for C/S transaction management

- Microsoft - Use of advanced tools and concepts (object oriented coding, etc.) to automate the systems building process. Reusability at applications product level.

- HP - C/S applications model and transaction management

- Andersen - Re-engineering process and (probably) reusable applications modules.

10. Cost of Making Improvements in Systems Building (Funds, People, and Opportunities Foregone)

The following is HP's educated guess:

- In addition to whatever investment cost their might be in designing a new process or technique, the first time the process is put into use on an actual systems effort, there is probably a twenty percent penalty in development cost.

- On the second attempt the penalty probably drops to 10% and on future efforts gains in productivity can be made in the order of 10-20% per effort.

To pull together HP's C/S model probably cost between $500K and $1M. This doesn't count the many hours that were invested in developing stand alone components which were used in the model. However, benefits are there from the developers viewpoint.

After two years of working with the model in actual development efforts, they are probably delivering systems at 80% of the cost for these same systems developed using conventional methods.

11.   Success/Failures

The C/S development model has been Hp's biggest success. On the failure side, early on they had an occasional disaster in terms of actually using the model to do a client implementation.

12.   Other Organizations to Watch

HP is probably ahead of the average firm in rethinking and actually implementing changes to the software building process. They believe they were probably far from the head of the pack. They don't think that there was any one firm who was the leader in all aspects of the process.

13.   Charging for Higher Value Software Assets

HP doesn't feel that the asset value of individual custom designed systems will improve significantly as the direct result of improvements to the process; but does believe that the process will create new kinds of assets.

The business process models developed as a result of re-engineering can and (in a few instances) are being sold or brokered. Repositories of basic business processes will one day be sold. Using these models through a medium such as IEF, other firms could tailor both the processes and.the code to meet their particular business needs. One example cited was an airline used TI to broker its IEF model for frequent flyer operations to another airline serving a non-competitive market.

1.   Changes in the Software Building Process (Overall)

There are changes being made by groups in a number of areas including professional services, external consulting, SI projects, ISSC and internal software groups. IBM's interests include business systems planning, project management, methodologies and tools. Separate activities are also being carried out with business partners.

Internal professional services and software groups are under pressure from users to speed up the development process or time to develop an application system. The reduction of development time by 50 to 100% is mentioned by users as an objective although any meaningful reduction in the overall process (e.g., 20 - 33%) would be well received. IBM recognizes these objectives, but does not have a specific target. However, IBM recognizes that changes of this magnitude will require consideration of all aspects of the process from concepts of business analysis and re-engineering to project management and code generation.

Users also want to reduce the cost of developing software for a system. The reductions being sought by users are at least 30 to 40% and as much as 100% Although there is not any official target, IBM research in Endicott, NY has talked about helping users achieve a reduction of 25 to 30%.

Another objective is to allow the time and cost required to modify software to be reduced.

A different type of objective is to develop software with a higher level of quality. In addition to programs that can be more easily modified and understood, two concepts were mentioned in regard to this. Users have stated that they are interested in systems building that would automatically incorporate various types of input data validation and other cross footing that is suitable for the type of application being developed. The second concept involves enriching the development process or adding tools which will check out the logic of software during the process and leave a structure in place for acceptance testing and testing of modifications at a later date. Auditing should also be facilitated.

Many ideas about quality are prevalent. One recommendation mentioned by users is to ensure that developed software should not be fragile or become fragile when normal types of changes are incorporated or added. Users also feel that procedures or tools should guaranty that software modules can be reused or used as an object(s).

2.   Soft Benefits

Software should facilitate efforts to communicate as well as to analyze what is going on in business processes. There should be a view(s) of software that enable users to review systems and give them a feeling of satisfaction with the software.

3.   Relative Contribution of Tools and Processes

CASE won't achieve all the objectives that are being discussed for software but CASE tools can aid by enabling software to be analyzed, modified and generated more easily for a number of applications. It was noted that certain applications that require high levels of transaction processing might require attention from personnel that were experts in the alternatives and tools available to meet tasks. One project mentioned in this regard involved an RS/6000 system that AIC worked on in conjunction with the research staff in Austin.

An expert on GUI has been hired by IBM in Endicott, NY to develop special tools to support and guide developers in implementing certain types of workstation systems faster and with more quality.

In regard to the use of tools, it is felt that AI and particularly expert systems, as well as other capabilities should be able to be incorporated as objects in the software development process.

It is felt that the process of systems development must address a much broader set of needs than tools can address. For instance, it must address changing work structures such as work groups and other changes in work organization or people management.

Ideas for the application of manufacturing techniques to software building are also being considered, tracked and experimented with although it is felt that it may be difficult to achieve other objectives such as improvements in communication as mentioned above together with software manufacturing.

4.   Reusability

Reusability was mentioned several times as an objective in relation to the goals stated above. The objective was stated as creating software that can be reused and/or facilitate the reuse of other software whenever feasible.

Ideas have been tried out internally by IBM in Boca Raton, Austin, and other locations to reuse software during systems software development.

Research projects have also been carried out to test reusability and other concepts and to track user and vendor work with reusability.

5.   Difficulties in Addressing Client/Server

Difficulties involved in separating processes or splitting the management of data have not been fully addressed. IBM thinks that these problems have often led to the use of larger capabilities, AS/400s rather than work stations, in many client/server systems.

6. Is More Than One Process Model to Improve Systems Building?

IBM has a number of process models available to improve systems building and is constantly in contact with other vendors to make arrangements to share and try out their ideas (e.g., recent agreement with HP on client/server development products). They have a low degree of control over the management of change. Many offices (but not all) are supportive of change due to this. IBM contacts in professional services assignments feel that this emphasizes that the most important element in the improvement of systems building is the experience and knowledge of industries and application systems.

IBM points out that some large corporations such as several of the top banks are trying to use more than one process model for improving systems building. This has occurred chiefly due to unplanned pressures by users for different alternatives for systems building. There may not be an adequate means of managing or coordinating change in these situations even if IS tries to coordinate or manage change in situations where more than one model is operative.

Some areas of organizations are more supportive of change, particularly users who are under pressure to achieve business goals.

7. Skill Needs and Distribution

Skills are still in short supply and distributed unevenly. Hiring restrictions and staff reductions have made it difficult to get the right people. The IBM culture still places great emphasis on training. Proactive steps to improve the situation include arrangements with vendors that can aid with or participate in improvement in software building.

8. System Testing Process

Users are being brought in to systems testing to a greater extent. New types of tools or systems review are being sought to improve the ability of users to test systems. Where vendors are involved in the supply of or development of software products, more accountability is being placed upon them during systems testing.

9. Particular Innovations

Innovation of various types is being tried by corporations in contact with IBM including the development of specialized tools internally or by vendors, the generation of objects in C++ code that can be used to add necessary functions to a number of systems, the use of specialized CASE approaches, greater reliance on vendor application software products and experimentation with new types of languages. One effort that IBM is engage in with a user involves the use of specialized GUI that aid a developer to combine objects. Use of the GUI will guide (and force) the developer to include various types of controls and aids that will facilitate testing and operation of the resulting system.

IBM is also conducting research on ideas about GUI that use symbols other than icons. One of these concerns the use of symbols that would aid a person involved in a work group structure.

10.   **Cost of Making Improvements in Systems Building (Funds, People, and Opportunities Foregone)**

The cost of making improvements can not be tracked on an overall basis in IBM and is not being tracked in most organizations. IBM is willing to make improvements to obtain near term business or to improve capabilities over a longer term. It is felt that many short term efforts should be undertaken in order to ensure that IBM will be aware of the more outstanding improvements.

11.   **Success/Failures**

Failures or the inability to achieve total objectives has been notable in some CASE projects as well as projects run by IBM that were supposed to improve software building. A major lesson that was learned was that the business objectives and processes are sometimes neglected or not reviewed sufficiently and rethought during projects that automate systems building.

12.   **Other Organizations to Watch**

The vendor mentioned most often as one who is or may be achieving such improvements is Microsoft. They have been building and rebuilding software objects so that they can be joined together more easily. Visible Basic has been improved and re-coded in C++ to provide users the means of reviewing and adding to or modifying objects in a more easy fashion. The Next operating system of Jobs was felt to be a good step in the direction of improved development, but is not spoken of lately. Products such as Powerbuilder and the Insynch Passport system that generates C code are also being reviewed in addition to the products of TI, KnowledgeWare, Bachman and others whose products are under constant review.

13.   **Charging for Higher Value Software Assets**

Although it is believed that higher value software assets will be developed, there are unanswered questions about the ability of a vendor to achieve sufficient recognition for the software assets put in place so that a premium can be charged on a near term basis.

Oracle

1. Changes in the Software Building Process (Overall)

The principal changes taking place in the process are driven by three fundamental driving forces.

- A migration from IS to the end-user as the leading player in the development process.

- The maturation of a new life cycle based on rapid prototyping, utilizing increasingly sophisticated tool sets.

- A growing demand for rapid turnaround and responsiveness for changes to whatever system is in place.

Both downsizing from the mainframe and upsizing from standalone departmental systems to departmental work group systems is occurring simultaneously. In either case, the traditional life cycle that was used for mainframe development is or will be replaced by the cycle described below.

- Rapid prototyping of a systems basic functionality. (Joint effort of specialists - either vendors or IS - and end-user experts.) The prototype then goes into limited production.

- Refinement and rollout of the full blown system. (Joint effort of specialists and end-user experts, and based on feedback from operating the prototype in production mode.)

- Integration of the refined system with related systems. (Primarily a specialist implementation activity based on requirements identified while operating the refined system in production.)

In other words the traditional concept of a formal requirements phase is replaced by three less formal requirements definition phases. In fact each phase of the traditional life cycle has a three counterparts in the new cycle; design, development, testing, etc.

Oracle sees itself as being involved in this process in several ways:

- As an innovative tool supplier

- As a teacher/coach

- As a high level consultant and/or implementor

- As a developer of applications software (for internal use or, perhaps, in partnership with a client)

- As a supplier of flexible applications (where Oracle may again become involved as a teacher, consultant or implementor)

These are complex roles and Oracle is the first to admit that everything isn't sorted out yet.

Meeting the real business requirements of the end-user, and shortening the time from inception to delivery in order to capture user benefits early. This fundamentally comes down to:

- Reduced training time

- Shortened development cycle to first usable version of the system

- User self-sufficiency in terms of on-going modifications, etc.

Oracle does not believe that there is likely to be a reduction in systems development costs (at least in terms of reduced manpower) over time. The more likely scenario is that implementations will have four to five times the functional capability for the same cost.

Oracle believes that the creation of new interactive applications using their redefined life cycle and tools can be accomplished in 70% of the time it would take to achieve the same functionality using conventional CASE and methods. For batch based applications or the generation of new reports, etc., they believe the number is 25%. (See attached diagram showing how newer approaches to system building generate benefits.)

Quality is customer satisfaction with the provided functionality, and "0 defect code".

In a homogeneous environment (Oracle Platform) they estimate that a fair amount of the code can be re-used. But this is not an objective unto itself. In heterogeneous environments (say using DB2 along with Oracle), less will be achieved in terms of reusability.

Oracle believes that the industry is a long way off from obtaining reusability on any major scale through the development of "objects". Probably the highest level of reusability comes through the creation of user "customizable" applications software products.

Very little quantification of benefits has been done. Most end-user projects (which are an increasing proportion of the total) seldom undergo a formal justification or subsequent audit process.

2. Soft Benefits

As firms begin to leverage the concept of information distribution and collection utilizing the interactive capabilities of modern technology significant benefits will be realized in terms of better communications both deferred and direct. This will include interaction between individuals in a firm as well as between an individual and the corporate repository of knowledge. Applying these same systems design concepts to interactions with customers, etc. will bring another whole set of benefits.

The typical knowledge worker spends between 10-15% of his/her time today interacting with paper. As the level of integration of systems goes up and the ability to interact on an as needed basis with the corporate repository grows, knowledge workers will spend probably 20-25% of their time working with information electronically.

In Oracle's view we're just seeing the tip of the iceberg in terms of understanding, articulating and realizing some of the significant benefits that can be achieved through the migration to interactive systems at all levels.

3.   Relative Contribution of Tools and Processes

New tools and changes in processes are probably making an equal contribution; and they continue to evolve in an iterative manner. The methodology that Oracle endorses of rapid prototyping, refinement and integration has stimulated the need for new functionality in the tool set. And, the capabilities that are subsequently generated in the tool set provide opportunities for further refinement in the design and implementation processes.

CASE tools are either obsolete or essential. If they are integrated with rapid prototyping methodology and deal with the concept of distributed architecture, they are essential. Tools that "assume" the kinds of structured methodologies of the 70's and 80's are probably obsolete because they don't integrate with current methodologies or architectures.

AI, like many other buzz words (including CASE), has gotten a bad name. However, if you look around, you'll see that expert rule based systems are imbedded in everything from spreadsheets and word processors to systems development tools. The use of these technologies to support the systems building process will continue to grow, and will result in both reduced development time and higher quality code.

The biggest single change on the people and organization side was the migration of development responsibility from IS to the end-user. Distributed IS has changed the process. The result is more teamed approaches which hopefully combine the required technological expertise with user knowledge of business process.

In terms of management techniques, people are still going to be people and managers will still vary in quality. However, the teaming of users and technical personnel in the development process will and should continue to reduce the complexities of management by improving communications. New tools and processes will continue to reduce the number of people required to accomplish an implementation (and therefore the complexity).

Oracle believes there is some fallacy in the notion of "manufacturing" code. Manufacturing implies making a large quantity of the same (or essentially the same) thing. Building applications involves using common processes to generate unique systems. The thing that they have in common is the use of consistent (but obviously different) processes... little else.

4.   Reusability

(See Question #1)

From Oracle's point of view, reusability is an objective. However, a lot of effort will need to be placed into the development of standards, and the consistent use of sophisticated tools before this will be accomplished through "object" libraries. In the meantime, Oracle targets on being able to reuse higher level application definitions to "regenerate" code. Modifications to the definitions at the high end allow customization; and the use of tools allows new custom code to be generated at minimal cost.

There may not be much progress was likely to get made in generating reusable modules at the user interface, since this is an area where systems providing similar functionality were liable to vary significantly based on personal and organizational preferences.

5. Difficulties in Addressing Client/Server

Oracle believes that the C/S model is incomplete. When utilizing a consistent platform on any given set of applications (the Oracle platform) they have a consistent way to model the distribution of processing and data. It's pretty straightforward. Shared functions and data go to the server, and unique functions and data go to the client. However, when working with heterogeneous platforms (in particular data bases), the ability to follow the model is frequently inhibited by differences in functionality in hardware and software.

Over time, the migration to more open systems and standard interfaces will likely increase the level of consistency that can be achieved in allocating data and processing in the C/S environment. In any event, its not a serious enough problem that it is likely to inhibit the ongoing emergence of C/S as the primary applications platform.

6. Is More Than One Process Model to Improve Systems Building?

Yes, Oracle is certainly trying more than one model. Two examples have already been cited; the rapid prototyping process and the creation of "customizable" applications packages. More are likely to be tried in the future.

In terms of how the process is being managed... at Oracle it's ad hoc. Overall, they have a low degree of control over the management of change.

7. Skill Needs and Distribution

Oracle, being a technology company, makes heavy investments in training, and provides numerous incentives for self-development. On-going training and development is just part of the culture. So fundamentally, Oracle doesn't feel that it's facing a any significant problem in finding or developing the skills that it needs.

In general, Oracle sees the distribution of IS skills to user organizations is a significant change, and will continue to happen throughout the decade. In terms of skills bottlenecks, Oracle believes that these are largely transient effects.

8. System Testing Process

Testing is becoming an on-going continuous process. The objective is no longer just to meet a written specification, but to insure that the customer is satisfied with the cost, functional performance and time to delivery of the system. In a sense this increases the complexity of the entire testing process, and places the "pass fail" judgment directly to the user.

In terms of actually testing finished code, major tests are built in at each of the three major phases of the Oracle process (rapid prototyping, refinement, integration).

The process of regression testing of software is growing more complex. As more and more functionality is included, the possibilities that need to be tested multiply exponentially. Some automated processes have been put in place, but manual testing of individual products is still required.

9.   Particular Innovations

*   More and more integration of applications systems and data

*   Installing methodologies which permit the continuous refinement of systems

*   Providing tools and methodologies which allow users to achieve high levels of self-sufficiency in terms of managing their own systems environment.

10.   Cost of Making Improvements in Systems Building (Funds, People, and Opportunities Foregone)

Unfortunately this is something that isn't measured. Partly because what is being done is intertwined with so many other activities, it's not clear that even a heavy investment in the measurement process would produce a result of significant value. However, major investments in new methodologies and tools were looked upon by users as long term investments. Only when the first applications came rolling out under the new approach would people begin to realize the potential savings or pay back.

11.   Success/Failures

It's no secret that Oracle's biggest failure was in its initial approach to the applications software market. The products (originally developed for internal use) were low in quality and functionality, support was low quality, and sales commitments exceeded the deliverable capability. This problem is behind them now, and caused a major rethinking about the entire applications building process which forced Oracle into its new direction - with benefits all around.

12.   Other Organizations to Watch

Some significant improvements are being made in the pharmaceutical industry. (Examples which confidential.) There are similar developments in the chemical where the adoption of new techniques and approaches to systems is allowing high levels of integration improving overall productivity to the firm.

13.   Charging for Higher Value Software Assets

The actual asset value of software will probably go down as it becomes easier to build and is replaced more quickly. However, the value of the "information asset" will likely rise significantly as newer applications and software systems permit its distribution, collection and utilization in ways that weren't previously possible. Whether anyone can measure these values is debatable.

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